# A Vision without a Sight: From Max Bense's Theory to the Dialectic of Programmed Images

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## Abstract

Based on semiology (Pierce) and Information Theory (Shannon & Weaver, Carnap), Max Bense's philosophy is essential for understanding the beginning of Computer Art in Germany in the sixties. However, Bense's programmed aesthetics is primarily concerned with literature and text (*Textheorie und Textästhetik*). Discussing numerical methods that are capable of "describing a text by means that are nearly the same as those used by thermodynamics to describe a gas", Bense, a poet and a philosopher, envisions the idea of a programmable text synthesis. A critical reading of volume IV of *Aesthetica* reveals that his approach, influenced by various experiments in Europe, creates a parallel between statistical science, programming and literature theory. But although referring to the work of art, the philosopher does not yet relate the term *programming* to image.

In 1960 alongside *Aesthetica IV*, in Stuttgart, and together with his wife Elisabeth Walther, Max Bense starts the *Edition Rot*, an experimental publication that will progressively bring together concrete poetry, semiology, typography and cybernetics. In the famous nineteenth issue dating February 1965, *Rot* inaugurates the Generative Aesthetics by a statement written by Bense, together with a set of computer drawings by the mathematician and artist Georg Nees. From a historical perspective, these drawings are among the first programmed artistic images ever made public. Looking closer at Elisabeth Walther and Max Bense Estate archive at the Center for

Art and Media Karlsruhe (ZKM), and focusing especially on the documentation of the *Edition Rot* – including its drafts – one discovers diagrams and notes which traces back editor's views. Studying this material notably enables us to understand how the philosopher becomes an instigator of Generative Aesthetics in the visual arts.

For pioneers of Computer Art, including Frieder Nake and Georg Nees – both attending lectures of Max Bense – programming plays a role of formal description that precedes the materialization of the image. In the discussion of these images, a problem opens. While the generative work has already been described in the form of an algorithm, how does one analyze the resulting image? What happens in the

dialectic between the programmed synthesis and the visual analysis of the image? A possible answer is that it is in this dialectic that a new thinking and a new mode of existence of the image occur. The hypothesis is that the discussion of algorithmic image entails the reconsideration of how description and analysis are articulated in the image process. We will test this hypothesis by studying the editorial engagement of Bense, but also by studying the work of Georg Nees and the theory of Frieder Nake. Here, Max Bense's vision is discussed from concrete poetry to the world of programmed images.

## Introduction

On 28th of October 1960 the art magazine *Kunstgespräch* published a review of Max Bense's new book *Programmierung des Schönen* [1][2]. On the page succeeding the editor's note, Bense was controversially called the Muse Killer because of his emphasis on rationalization of aesthetics.

Max Bense's philosophy vividly nourished the beginning of Computer Art in Germany during the sixties. At the crossing of Information Theory and semiotics, his founding of Information Aesthetics and more specifically of Generative Aesthetics connects him with what is now broadly known as the digital arts. However, Bense's major contribution to Information Aesthetics in *Programmierung des Schönen* is primarily concerned with literature and text (*Textheorie und Textästhetik*).

This paper looks at how his philosophy introduced the term *programming* into aesthetics and art. In order to understand his vision, his role as the leader of the intellectual circle of Stuttgart school and particularly his relation with publishing must be investigated. Rot is an experimental publication in semiotics and

concrete poetry whose editors are Max Bense and his wife Elisabeth Walther. It is studied here, especially to point out Bense's relation with the world of images.

The issue n° 19 [3] and its archived material at ZKM is specifically analyzed for it is the famous issue in which Georg Nees premiered his computer graphics. This issue also contains Bense's *Generative Aesthetics Projects*. The study of the archive material reveals more details about Bense's intentions while editing programmed images. Nees's graphics are accompanied by the presentation of the algorithm in plain text. Prior to the image, this description adds a new discursive dimension away from the sense of sight. Although it is text, the program already contains the image.

The main thesis – the dialectic of the algorithmic image – is finally discussed by observing on the one side the synthetical theory of Max Bense and on the other side the algorithmic thinking of Computer Art pioneer Frieder Nake.

## Programming the Beautiful

Max Bense (1910-1990) studied mathematics, physics, geology and philosophy at the Bonn University where he gained his Ph.D. and Sc. in December 1937 [4]. Based on semiology and Information Theory, his philosophy is essential for the understanding of the beginning of Computer Art in Germany in the sixties. Not only Bense is significantly inspired by Norbert Wiener's *Cybernetics* but he also founds his philosophy of aesthetics on the relation between mathematics and the arts [5].

In 1960, while being a senior lecturer at the University of Stuttgart, Max bense publishes *Aesthetica IV: Programming of the Beautiful. Aesthetica* represents a body of four books that Bense started in 1954. *Aesthtica I* deals with the

*Metaphysical Observations on Beauty,* Aesthetica II is already concerned with *Information Aesthetics* (1956), and *Aesthetica III: Aesthetics and civilization* (1958). Later, in 1965, the four books of *Aesthetica* were reedited together in a single book with few images under the general title *Aesthetica. Introduction to the New Aesthetics* [6]. In this last book, a fifth chapter was added. It comprises a foundational text titled "The Project of Generative Aesthetics" (originally published in February 1965).

Max Bense as a philosopher has established influential theory for the early Computer Art scene of the sixties. His publications are found in the main international art events concerned with the *Computer's Arrival in Art* [7]. Together with Abraham Moles and Umberto Eco, Max Bense is staged in international events in London and Zagreb as a forerunner of early Computer Art. However *Programmierung des Schönen* is firstly concerned with literature and text theory:

"Max Bense's Informational Aesthetics concludes with a General Text Theory, which, on the basis of statistical research by Fucks, Herdan, Mandelbrot, et al., can be understood as a model of the new statistical aesthetics of sign. The general text theory refers to any kind of text, including the aesthetic theory of poetry and prose, but also of scientific languages, advertising languages and abstract languages, etc." Translated from German. Reinhard Döhl, Aesthetica IV (jacket), 1960.

Through the book, Bense refers to programming in different ways. What follows is a critical reading focused on the use of the word *programming* and its derivatives. It will then discuss the notion of programming in Bense's perspective. By extension, it will also enable a view on what is the relation of the philosopher with visual art and visual programming.

In his introduction, Bense seems impressed by various experiments in Europe. In 1960, his theory in aesthetics is not unique. While discussing numerical methods that are capable of "describing a text by means that are nearly the same as those used by thermodynamics to describe a gas", Bense is conscious of the efforts of others in the information theory discipline (in music with Abraham A. Moles, also in journalism at Centre International d'Enseignement Supérieur du Journalisme in Strasbourg, …). Although it is mentioned that "at the Technical University in Stuttgart one tries (...) to achieve an aesthetic programming of texts and visual character complexes", it remains a question how familiar Bense was with the practical aspects of such experiments at the time. In fact, in 1959, Bense already published *Stochastic Poems* of Theo Lutz in his literary magazine Augenblick [8]. In 1958, Bense hears about the attemps of Theo Lutz, a student, who uses a computer, model *Zuse 22* to compose texts. Bense suggests him to program the computer with a selection of words from Franz Kafka as well as a simple grammar, which he will then publish.

For Bense, the activity of programming is dependent on literary theory. Programming literature finds its justification in the fact that there is a theory of literature. By extension, programming becomes in itself a form a literary theory.

"It is not possible to explain, understand, interpret, or program literature without the presuppositions of certain theories, the task of which is to explain, understand, interpret, or program." Translated from German. Max Bense, Aesthetica IV, 1960

In this perspective, it is the task of theory to program literature. The computer is not a tool for literary analysis, but for literary and text synthesis (i.e. production) [Ibid.].

Furthering his views on literature theory, Bense enlarges the category to text theory. This theory has to embrace a broader spectrum of texts including reportages, features, series, news, advertising, announcements and visual communication. Based on the Information Theory, every text can be understood as a message, both from an analytical and a synthetical point of view. Also inspired by authors such as Gertrude Stein, Joyce, Ponge et al. and underlining the fact that these authors have already opened a way to the programmability of text, Bense finds in synthesis the promise for a new experimental discipline in the field of aesthetics.

## Logical Programming

In *Aesthetica IV* (1960, p67), Bense also refers to the theory of Rudolf Carnap. Carnap was a philosopher who advocated logical positivism. For him, philosophy is the construction of language for science, freed from metaphysics. In 1952, together with Bar-Hillel, Carnap publishes at MIT "An Outline of a Theory of Semantic Information" where he presents a distinctive approach to the then current Theory of Communication [9]. Whereas the admitted theory (Shannon & Weaver) treats amounts of information as a measure of the statistical rarity of a message, Carnap and Hiller build a theory in which the concept of information carried out by a sentence within a given language system is treated as synonymous with the content of this sentence. Semantic information is explicated by various measures of this content. Taking on Carnap's terminology for studying text (molecular and atomic predicates), Bense takes an example from the theory of Carnap in the quantification of properties (Q) for a conjunctive proposition such as P1•P2•P3 where the predicates can be either negated or non-negated (e.g. –P1 or P1). Bense applies the theory to a text example: "Red and sweet and

achievable". By principle of combination, this system of text bears 8 Q properties (In fact two at the power of three).

Later in the text, and by using the exact terms "logical programming", Bense specifically echoes the idea of constellation found in the concrete poetry of Eugen Gomringer. Through the idea of constellation, Gomringer offers a space for possibilities to happen: "The constellation is ordered by the poet. He determines the play-area, the field or force and suggests its possibilities. The reader, the new reader, grasps the idea of play, and joins in [10]." By writing in "a process of formal simplification" and with "a reduced number of minimal forms", Gomringer constructs an "object of thoughts and a play of ideas" [11].

Certainly the formal reduction found in Grominger's poetry echoes the needed reduction in modern programming language. But what are the differences between words chosen by the poet suggesting a constellation of meaning and the possible combination of words carried out by an algorithm? How to algorithmically explore words' combinations? We are testing here the properties of Bense's example of conjunctions. Our first step is to list and to write all the possible conjunctions contained by P1•P2•P3, where the predicates can be either negated or non-negated. As an example, one of the possible conjunction should be P1•P2•-P3. The practical realization of such an example can require two distinctive methods: iteration and recursion. An illustration is given here in Java-Processing code. We are assuming P1, P2 and P3 are tables of length two.

The code for quantification of Q properties:

```
String[] P1 = {"red", "blue"};
String[] P2 = {"sweet", "bitter"};
String[] P3 = {"achievable", "unthinkable"};
```

```
for (int i=0; i<=P1.length-1; i++){
  for (int j=0; j<=P2.length-1; j++){
    for (int k=0; k<=P3.length-1; k++){
      println(P1[i], "and", P2[j], "and", P3[k]);
    }
  }
}
```

The print function returns a list of all possible conjunctions ($Q = 2^3 = 8$):

red and sweet and achievable
red and sweet and unthinkable
red and bitter and achievable
red and bitter and unthinkable
blue and sweet and achievable
blue and sweet and unthinkable
blue and bitter and achievable
blue and bitter and unthinkable

Of course such a programming language didn't exist when Bense was writing *Programmierung des Schönen*. However exploring values and combination of binary numbers is elementary knowledge in computer science. We could argue that Bense's interest in both Carnap and Grominger is rather focused on either the logical reasoning or the brevity and compression of information and meaning in text. But Bense's understanding of computer science and the practicality of programming yet remains uncertain.

Bense's sense of programming will evolve. In an unpublished dictionary of aesthetics dated after 1971, Bense et al. define the term program in a now commonly admitted manner:

"Program, term of machine (electronic) information processing. The program is a system of rules that the machine must obey in order to carry out the intended result." Translated from Gemran. Ästhetik Wörterbuch, Moderner Ästhetik, unpublished [12]

Not far from an intuition, the effort of Bense in bridging programming and aesthetics in 1960 opened a new way for thinking literature and text. At the same time Bense maintained strong relationships with visual artists.

## Bense, Rot and the World of Images

"There are red secrets in the world, really only red ones." Translated from German. Ernst Bloch, *Edition Rot* (back cover), 1960-1997
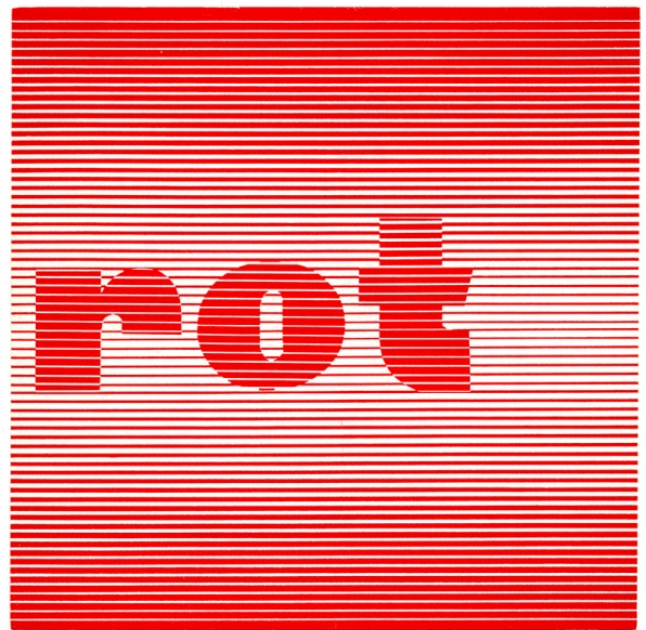
In parallel with the publication of *Aesthetica IV* in 1960 Bense starts the *Edition Rot*, based in St uttgart, which will progressively bring together concrete poetry, semiology, typography and cybernetics.

"The series Red is used for the publication of experimental literature and graphics. At the same time, the concept of experiment is not narrowly conceived. We expect everything that includes the form content and purpose of artistic production under the presupposition of a theoretically accessible aesthetic conception.

Experimental literature and graphics are created, incorporating all stochastic aleatory topological abstract and concrete techniques, and not limited to the natural modes of production of a creative individual, but also counting on the artificial production of electronic computing equipment." Translated from German. *Edition Rot* (promotion material). Max Bense, Elisabeth Walther, circa 1966

With its square format and its red dusk designed by Hansjörg Mayer, Rot is very recognizable from a distance (Fig1). Radically exploiting the Futura typography without capitals, Rot completes with 62 booklets which are extending from 1960 to 1997. Its categories are including poetry, prose, concrete poetry, philosophy, semiology, theory, photography, painting, drawing, typography, computer generated drawing, computer generated text, comic-strip and drama. The publication embodies the activities of intellectual group of Stuttgart which surrounded Max Bense and Elisabeth Walther. Among the published authors we find (in no specific order): Jean Genet, Abraham A. Moles, Charles S. Pierce, Hansjörg Mayer, Georg Nees, Yona Friedman, Francis Ponge, Dieter Roth, and many others. The journal is essentially concerned with concrete poetry and alternates frequently with issues dedicated to semiology and visual art. Two issues, the 19th and the 50th, are explicitly oriented on the programming of aesthetic forms, with respectively the generative drawings of Georg Nees (n° 19), and the poetry of Carole Sp. Mccauley (n° 50). It is also worth noticing that the number eight presents a text form Abraham A. Moles titled "First manifest of pemutational art" accompanied by a reproduction of an image from Vasarely [13]

In general *Edition Rot* presents an intellectual network linked by an interest in the text and the typographic sign. Given the involvement of Max Bense in the genesis of Computer Art, it may also seem surprising that the principle of a programmed aesthetic only appears in a minor way with two specific issues. Nevertheless, through each number, the text and image relationship progresses dynamically and it is not uncommon for an entire issue to be dedicated to a body of work that is only visual (e.g. Rot n° 27 in the spirit of New Realism with photographic work and collage by Reinhold Koehler).

Investigating the archive of Elisabeth Walther and Max Bense and specifically the one of *Edition Rot* at ZKM (E. Walther and M. Bense Estate) reveals a dense activity in publishing. How does Max Bense relate to the world of images appears far more complex than it might be expressed in *Programmierung des Schönnen*, which as we saw focuses mostly on literature and text theory. If concrete poetry is literature, it certainly also is an art of distributing signs in the two dimensions of the page. Observing publishing practices in Rot shows the attention of Bense to visual space.

Moreover Bense wrote numerous texts on fine art [8]. And it is also worth to notice that not only Elisabeth Walther was a semiotician, but she also was a photographer. Frequently, she shot various trips of Bense and her. It seems obvious that she would have had an influential role on the reproduction of photographic images in Rot (e.g. n° 60). But how as an editor did Bense specifically relate to the image material that was artificially or algorithmically produced? The archive reveals layers and drafts that participate to the layout of various issues including the famous Rot n° 19 [3].

## Computer-Grafik, Rot n° 19

In the issue nineteen published in February 1965 under the title *Computer-Grafik*, Rot inaugurates Generative Aesthetics with the publication of a statement by Bense himself [4]. In fact this issue is also dedicated to a text and a set of computer drawings by mathematician and artist Georg Nees who works at Siemens in Erlangen. From a historical perspective, these drawings are counting among the first programmed and artistic images ever made public [14]. Frieder Nake reports the public event that paralleled this publication at the "Studiengalerie der TH Stuttgart" as the first exhibition of Computer Art, "two months before the famous Howard Wise exhibition in New York" (both the exhibition at the Studiengalerie and the publication of Rot n°19 are dated February 1965). On the occasion of his *Aesthetic Colloquium*, Bense who has already been exhibiting artists in this space also presented the statistical drawing experiments by Georg Nees.

In the first two pages of the booklet, Georg Nees presents a text "about the programs of stochastic computer graphics". Not only we learn that every graphic has random parameters, but also Nees explains that each repetition of random parameters "produces the aesthetic improbability of the graphics". After the brief introduction, the text presents five parts written in the form of a pseudo code. Each part relates to one or two images that will be discovered in the next few pages: "8-edge: (image1)", "23-edge: (bimage2)", and so on. In plain text – without specification of any programming languages – the descriptions are presenting the programmable instructions that generate aesthetic results.

In the following images, the layout is systematic: the image title (e.g. "image 1"), the image itself in full page top to bottom, and the page number. A vertical white margin at the center of the double page borders the composition. The images that are presented are all made of black straight lines with approximately 0.5 mm stroke. These are verticals, horizontals, obliques. The shapes are either organized as patterns in a seemingly repetitive grid or as full page shapes made from complex superposition of various line densities. It is not specified in the publication: all images are originally ink drawings made with the help of an automated pen plotter.

Looking closer at Walther-Bense Estate archive at the Center for Art and Media Karlsruhe (ZKM), one discovers precious material concerning the way Rot n° 19 has been edited. Reproductions of the six images can be found on free glossy paper with various annotations in blue pencil from the hand of Bense. For *23-Edge* (Fig2.), it is worth mentioning that the last shapes at the bottom of the image are crossed out. The signature of Nees which is also situated at the bottom is crossed out too. Two blue lines and a vertical arrow in the left margin seem to indicate an instruction for cropping the image in the final layout.
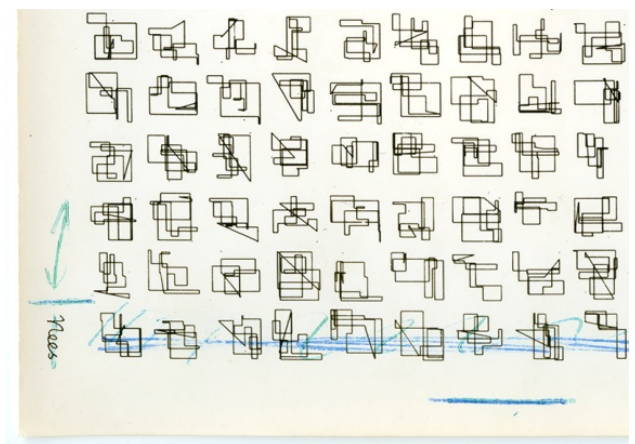


*Fig2. Georg Nees, 23-Edge: detailed view from editor's draft, Rot n° 19, 1965.*

What were the intentions of Bense? Is it because the name of Nees was appearing in signature that the last line of shape was removed from the edition? Or was it

simply for getting the grid of shapes closer to the square format of Rot? Although the exact answer is unknown; it is remarkable that this simple gesture of *framing* witnesses Bense's relation to authorship and to the new category of programmed images. In this case, it's as if the abstract signs algorithmically produced by Nees functions as characters that would have to be selected yet again after they are produced. It also significantly recalls Bense's interest in information and aesthetics realization as a process of selection: "Realization is an expression of a selection function" [2]. Moreover it also reveals that Bense's purpose might not have been to publicly present Nees as an artist but rather to demonstrate experimental application of his theories in the visual realm.

# Dialectics in the programmed image

For pioneers of Computer Art, including Frieder Nake and Georg Nees – both mathematicians attending lectures of Max Bense – programming plays a role of formal description that precedes the materialization of the image. In the discussion of these images, a problem opens. While the generative work has already been described in the form of an algorithm, how does one analyze the resulting image? What happens in the dialectic between the programmed synthesis and the visual analysis of the image?

For Bense, computation, deduction and measure are processes oriented towards future. In his vision, mathematical language enables the transition from physical processes in the natural world to productive principles within the technical and artificial world. According to him, the Humanities should radically reconsider its generative forces: "the reality-setting power of the humanities has not been verified" [1]. With programing, Humanities would shift from being analytical to being synthetical and hence experimental. A theory in aesthetics should be capable of artificially producing art. In the philosophy that Bense instigates, describing as well as programming precedes the realization of the art work.

Coming back to Nees's images in Rot n ° 19 wich counts as an historical inauguration of programmed aesthetics in the visual realm; we are left with few new questions. If Nees describes an algorithm and then exhibits the resulting image in the next pages, how to analyze and interpret the visual result? Is this about retrieving the formal logic that lies behind it? What are the critical tools that would enable a strong evaluation of the algorithm together with the aesthetic result? The thesis here is that a programed image whether scientific or artistic constitutes a dialectical unit. It is precisely because algorithm and image are inseparable that together they constitute a specific category of image. **The image exists both as an algorithm and as a visual material.** Frieder Nake for whom "computer art is conceptual art" precisely points out the dialectical tension between the algorithm and the visual work that is carried out by the means of computation:

"When the computer executes the description, it reads it in its own, peculiar way: it realizes exactly what the description requires it to do, and nothing else. Reading always is interpreting. The computer, when reading the operational text, interprets it. Absolutely different from our interpretation, the computer's interpretation is a determination: no freedom allowed. The computer interprets by determining the one and only one interpretation that makes algorithmic sense." Frieder Nake, Paragraphs on Computer Art, Past and Present, 2010 [15].

At the opposite end, we meet the visible surface onto which the image comes to existence. By becoming visible the work manifests itself in the material world, and because it is visible to the human eye it becomes subject to a new variety of interpretation. Frieder Nake also adds that by thinking in algorithmic terms we also share with the machine its one and only one interpretation:

"The result of an effort in algorithmic thinking is an algorithmic system. As such, it is in all its aspects unambiguous. This amounts to saying, there is one and only one interpretation of each execution of the algorithmic system." Ibid.

The tension between algorithms and aesthetics is not Bense's own formulation; instead it is to be found in Frieder Nake's theory and teaching [16]. Let's recall that Frieder Nake has actively been taking part in the Stuttgart circle. He has certainly been impressed by Bense's lectures he followed as a mathematician student in the university of Stuttgart in the beginning of the sixties. In November 1965, nine months after the presentation of computer graphic experiments at Bense's Studiengalerie mentioned above, Nake and Nees have exhibited together at the Niedlich gallery (Niedlichs Buchladen und Galerie), using the title *Computer Grafik* (slightly different from Rot n° 19). Since then, Stuttgart became a pioneering location for digital art and Bense's impulsion in Generative Aesthetics have been well followed and yet surpassed.

## Conclusion

By following Information theory and semiotics, Bense's vision bridges text theory and programming. Because of the close relation he maintained with visual arts, especially through the experimental publication Rot, the philosopher also opened a way to image synthesis in art. However the information aesthetics that he thoroughly defended didn't comprehend in detail the intricate and didactical relation between algorithm and image. "Think the image, don't make it!" This proposition from Frieder Nake expresses well the algorithmic dimension of computer generated image. Did Bense's vision lead to such a statement? Partially. Not only Nake has been closely involved in the events where Bense instigated Generative Aesthetics, but the synthetical theoretical means to statistically realize aesthetic states offered a strong basis for concentrating on the task of algorithmically describing the image before its realization. Frieder Nake insists that computer art is also a form of conceptual art. Bense, who claims that aesthetics must develop "under new aspects into a technical science" and who announces that programming meets creation, might not have fully foreseen the aesthetic tension these claims would create between the program and the image; and the algorithm and the visible. Confronting Bense's view to image synthesis and in particular to today's practice opens up a rich discussion that necessitates further research.

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## Figures

Fig1. Hansjörg Mayer, Rot, cover design, version of 1965. ZKM | Center for Art and Media Karlsruhe / Elisabeth Walther-Bense Estate / ZKM-01- 0129-02-0991-a

Fig2. Georg Nees, *23-Edge*: detailed view from editor's draft, Rot n° 19, 1965. ZKM | Center for Art and Media Karlsruhe / Elisabeth Walther-Bense Estate / ZKM-01